УДК 004.4

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RECOGNITION OF NORMAL AND ABNORMAL HUMAN ACTIONS

Abstract:
This paper presents an intelligent framework video surveillance system in an academic environment that takes into account the security and emergency aspects. The system proposes an abnormal human activity classification by the detection motion algorithm based on the Gaussian mixture model (GMM) followed by the Fuzzy C-Means (FCM) segmentation algorithm. It combines HARRIS-SIFT algorithms together to extract features, and the Kalman Filter for tracking targets. Finally, the K-Nearest Neighbor (KNN) algorithm used for the classification of the activities that belong to three different datasets tested. The results show the efficiency of the system: the datasets have the accuracy ratio 97%, the detection ratio is %97, and the false alarm ratio is 4%.

Keywords:
Gaussian mixture model, Kalman Filter, Weizmann standard dataset, KTH standard dataset.

Introduction

Computer vision is a major field of artificial intelligence that transformed into an extraordinary area of research in intelligent surveillance to the recognition of activities and classification of them into "Normal" or "Abnormal" ones using computers for processing, understanding, and analyzing data to make a smart decision [1,2]. Surveillance systems are classifier tools that support humans by expanding their cognitive abilities and decision making process [3].

The recognition of anomalies in the video is a difficult task. In particular, this process identifies three significant challenges. Firstly, anomalies cannot explicitly be identified, so systems must deal with uncertainty. The second is the deficiency of classified training data, so the annotated datasets are not considerable enough to learn efficient anomalies detection. Thirdly, video processing depends on manual- crafted features, which require extensive advanced knowledge and expensive of the computation [4,5].

From an innovative perspective, surveillance systems are classified into four fundamental generations. These generations advanced through the operator-controlled, to the basic automated, the smart surveillance, and the embedded smart surveillance [6].

The system proposes

The system proposes an abnormal human activity classification by the detection motion algorithm based on the Gaussian mixture model (GMM) followed by the Fuzzy C-Means (FCM) segmentation algorithm. It combines HARRIS-SIFT algorithms together to extract features and the Kalman Filter for tracking targets. Finally, the K-Nearest Neighbor (KNN) algorithm is used for the classification of the activities that belong to three different datasets tested: (1) Weizmann standard dataset, (2) KTH standard dataset, (3) Real scenarios created in the college campus called Real Corridor dataset.

This framework designed to consist of two processes: the first one is a tracking system that can follow each target to higher-level analysis with Identify sets of features to understand human activity and measure descriptive information of each target. The second one is a decision system that can define if a behavior track is normal or abnormal, and then generate a real-time alarm for security personnel.

The model has adopted a general protection approach, taking into account the security and emergency aspects by focusing on three abnormal activities: Falling, Boxing, and Waving (Fig. 1).

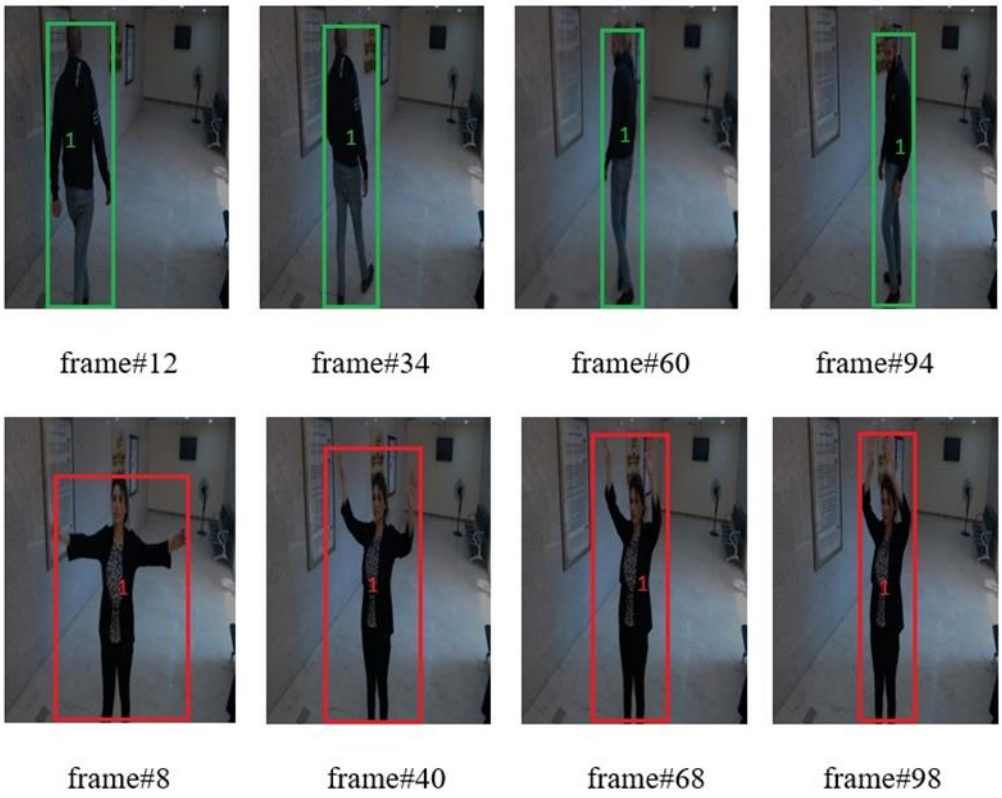

Figure 1 – Abnormal activities recognition: green frame - normal behavior; red frame - abnormal behavior

Conclusions

The proposed surveillance system framework makes it possible to recognize an abnormal human activity and generate a real-time alarm for making decisions by security personnel. Testing of the system on three different datasets show the efficiency of the system: the detection ratio is 97%, and the false alarm ratio is 4%.

There are some suggestions for development of the system: Focusing on more suspicious scenarios to progress the performance of abnormal activity detection; Taking into consideration of multiple humans overlapping and handling complex occlusion with tracking of humans across multiple cameras; Investigating more sophisticated algorithms and deep learning techniques to progress the system performance.

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